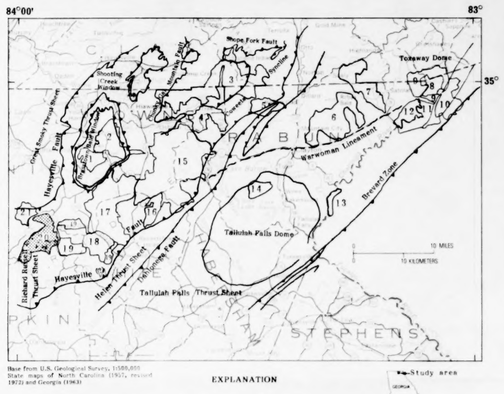
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF—1503-B



Base from U.S. Geological Survey, 1:500,000
State maps of North Carolina (1957, revised 1972) and Georgia (1963)

EXPLANATION

Wilderness Areas

3 Southern Nantahala Wilderness
8 Ellicott Rock Wilderness

Roadless Areas

1 Wolf Pen (08-149)
2 Brasstown (08-146)
4 Buzzard Knob (08-223)
5 Southern Nantahala (H8025)
6 Rahun Bald (08-147)
7 Overflow (08-026)
9 Ellicott Rock Extension (A8031)
10 Persimmon Mountain (L8116)
11 Ellicott Rock Expansion (08-112)
12 Rand Mountain (08-148)
13 Long Creek (08-113)
14 Worley Ridge (08-224)
15 Tray Mountain (08-030)
16 Anna Ruby (08-225)
17 Chattahoochee (08-029)
18 Raven Cliff (A8028)
19 Raven Cliff (H8028)
20 Blood Mountain (08-027)
21 Board Camp (08-145)

Figure 1.--Index map showing locations of wilderness and roadless areas and major structural features in northeastern Georgia and adjacent North and South Carolina. The Blood Mountain area is shown by a pattern. Number after roadless name is U.S. Forest Service identification number. Geology modified from Hatcher and Butler (1979) and Nelson and others (1987).

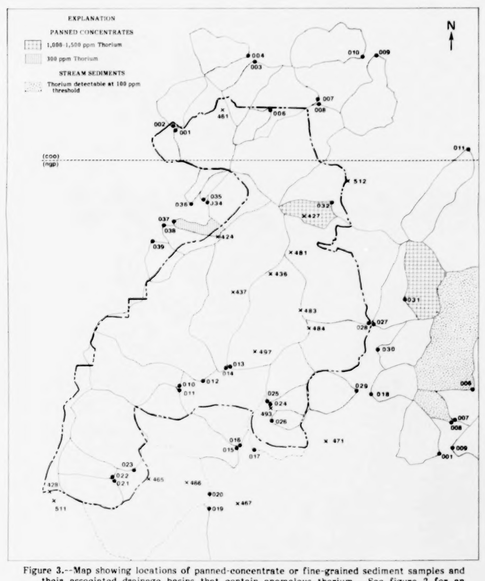


Figure 3.--Map showing locations of panned-concentrate or fine-grained sediment samples and their associated drainage basins that contain anomalous thorium. See figure 2 for an explanation of other symbols used.

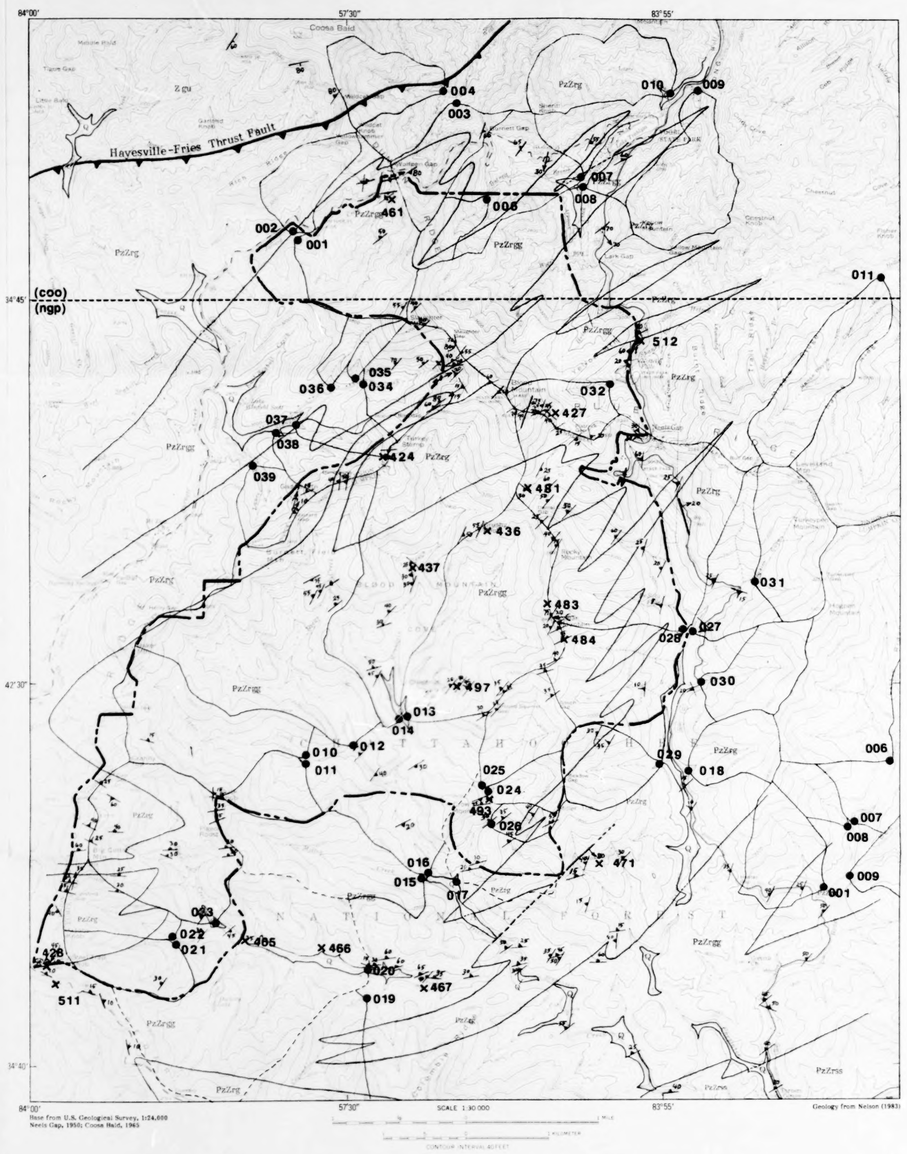


Figure 2.--Sample location map showing drainage basin outlines for stream-sediment and panned-concentrate samples, and major geologic units

EXPLANATION

Q — **Quaternary deposits--Unconsolidated colluvium and alluvium. Coarse bouldery and cobbly gravels, sands, and clay**

Rocks of the Richard Russell thrust sheet (modified from Koeppen and others, 1983)

PzZrg — **Chiefly biotite gneiss variably interlayered with and gradational into metasandstone and granitic gneiss; alternates with thin to thick layers of biotite schist, muscovite-biotite schist, hornblende gneiss, and amphibolite, calc-silicate layers, and granite and dioritic gneiss. Biotite gneiss is irregularly layered to massive. Pegmatites and granite pods and veins are common**

PzZrss — **Mostly metasandstone variably interlayered with and gradational into biotite gneiss, interlayered with biotite schist, muscovite-biotite schist, hornblende gneiss, and amphibolite. Discontinuous pegmatite, quartz veins and pods are common**

PzZrgg — **Principally migmatite of biotite gneiss and granitic gneiss. Biotite and granitic gneisses mixed in all proportions from small granite veins and pods in biotite gneiss to massive granitic gneiss exposures containing only thin wisps of biotite gneiss. Commonly associated with pegmatite pods and veins, and quartzofeldspathic lenses**

Zcu — **Undivided Late Proterozoic rocks of the Great Smoky thrust sheet--Alternating beds of metasandstone, metaconglomerate, and mica schist; includes some bodies of granite gneiss.**

Contact--Approximately located. Dashed where concealed

Fault--Dashed where approximately located; shows dip

Thrust fault--Approximately located; sawteeth on upper plate. Dashed where concealed

Approximate boundary of roadless area

Strike and dip of bedding

Strike and dip of layering and foliation

Strike and dip of foliation

Inclined

Vertical

Horizontal lineation

Bearing and plunge of lineation

Minor synform showing plunge of axis

Minor antiform showing plunge of axis

Overturned antiform showing plunge of axis

Abandoned quarry

004 — **Outline of drainage basin--Dashed lines indicate greater order drainage basins. Dot indicates U.S. Geological Survey stream-sediment sample location. Stream-sediment sample number should be prefixed with either COO (for samples from the Coosa Bald quadrangle), or NGP (for samples from the Neels Gap quadrangle). See dashed line on map marking quadrangle boundary**

×467 — **U.S. Geological Survey rock sample**

Table 1.--*Statistical summary of geochemical data for the Blood Mountain Roadless Area, from data in Siems and others (1988). Data from other wilderness areas shown for comparison*

All analyses in U.S. Geological Survey laboratories, Denver, Colo., by D.F. Siems using semiquantitative spectrographic methods, except for zinc in panned concentrate MI (1.0 amp magnetic) fraction which was determined by atomic absorption methods by D.F. Siems. Spectrographic analyses are reported as six steps per order of magnitude (1.0, 0.7, 0.5, 0.3, 0.2, 0.15, or multiples of 10 of these numbers) and are approximate medians of geometric brackets whose boundaries are 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12, etc. The precision is expected to be within one adjoining reporting interval on each side of the reported value 83 percent of the time; MI, 1.0 amp magnetic fraction. Symbols used: >, amount is greater than number shown; <, amount is less than number shown; --, not detected.

	STREAM SEDIMENTS										PANNED CONCENTRATES							ROCKS (GNEISS)							
	BLOOD MOUNTAIN n=57			AR[1] n=19	CR[7] n=51	SN[9] n=171	CM[2] n=30	ER[3] n=103	SR[5] n=94	TM[4] n=87	BLOOD MOUNTAIN n=45			CR[7] n=41	SN[9] n=139	AR[1] n=12	CM[2] n=10	ER[3] n=76	TM[10] n=78	BLOOD MOUNTAIN n=15			CR[7] n=10	CM[2] n=16	SN[9] n=148	ER[3] n=10	SR[5] n=37	Average[6,9] sandstone
Element	Low	High	Median	Median	Median	Median	Median	Median	Median	Median	Low	High	Median	Median	Median	Median	Median	Median	Median	Low	High	Median	Median	Median	Median	Median	Median	
	PERCENT													PERCENT									PERCENT					
Calcium	0.07	1.0	0.3	0.3	0.15	0.5	0.6	0.3	1	0.3	<0.1	0.3	0.15	0.15	0.2	0.3	0.07	0.5	0.2	<0.5	2.0	1	0.3	0.7	0.5	1	1	3.9
Iron	3	10	7	2	3	5	5	2	7	2.5	.15	.7	.3	.7	.7	.5	2	15	.3	5	15	10	5	2.5	3	5	5	.98
Magnesium	.3	2	1	.5	.5	.7	.5	.3	1	.3	<.05	.2	.05	.1	.07	.2	.5	.15	.1	.2	3	1	1	.7	1	1	1	.7
Titanium	.5	1	1	.5	.5	1	.7	.3	.5	.4	<2	<2	>2	1.5	2	1.4	>1	>1	1.2	.3	7	.5	.3	.5	.5	.5	.5	.15
	PARTS PER MILLION (ppm)													PARTS PER MILLION (ppm)									PARTS PER MILLION (ppm)					
Barium	300	1,500	1,000	500	700	300	500	500	500	330	<50	500	200	70	50	300	125	100	90	100	1,500	700	1,000	500	500	700	1,000	300
Beryllium	<1	1.5	1.5	2	1	1	1.5	<1	1.5	1	<2	2	<2	<2	<2	<2	<1	<1	--	1	3	2	2	1	1	1	1	2
Boron	<10	15	<10	<10	10	<10	10	10	15	10	<20	20	<20	<5	20	20	20	20	--	<10	20	<10	<10	<10	10	<10	10	35
Chromium	70	150	100	70	50	70	50	20	100	50	30	500	250	70	100	50	200	100	80	70	200	100	100	30	30	60	50	35
Cobalt	10	30	20	10	15	10	20	7	15	15	<10	30	20	<10	<10	<10	7	15	20	<5	20	10	10	10	10	7	10	.3
Copper	10	70	50	20	20	15	20	7	20	20	--	--	<10	--	<10	<10	7	<5	20	<5	300	30	30	10	10	10	15	10-20
Lanthanum	30	1,000	300	100	150	50	150	30	100	50	<50	>2,000	50	50	100	200	400	500	150	20	200	50	150	30	50	50	50	7
Lead	10	50	20	30	20	15	30	20	50	15	<20	100	20	<20	<20	<20	<10	<10	45	<10	50	20	30	13	15	40	20	7
Manganese	300	1,500	700	700	500	1,000	2,000	300	1,500	550	20	100	100	150	100	100	300	5,000	80	100	1,000	500	500	700	700	500	700	500
Molybdenum	--	--	<5	<5	<5	<5	<5	<5	<5	<5	--	--	40	<10	<10	<10	<10	<5	--	--	--	<5	<5	<5	<5	<5	<5	.2
Nickel	10	50	15	15	20	20	20	10	20	30	<10	30	10	10	<10	<10	10	<5	30	7	100	30	10	15	15	10	20	2
Niobium	<10	50	15	<20	<20	<20	<20	<20	<20	20	<50	1,500	300	100	<50	<50	25	50	70	<10	70	<20	<20	<20	<20	<20	<20	.8x[10]
Scandium	15	50	20	7	15	7	15	7	15	10	30	100	70	70	<10	<10	5	30	30	10	30	15	15	10	10	10	10	1
Strontium	<100	200	<100	<100	<100	100	200	<100	150	100	<200	300	<200	<200	200	200	<200	<100	--	<100	500	100	200	180	200	150	200	20
Thorium	--	--	--	<100	<100	<100	--	<100	<100	--	<100	1,500	<200	<200	<200	<200	--	<100	--	--	--	--	<100	<100	--	--	<100	<100	5.5
Tin	<10	--	<10	<10	<10	<10	<10	<10	<10	<10	<20	70	<20	<20	<20	<20	<10	--	--	<10	--	<10	<10	<10	<10	<10	<10	<10	.x[10]
Vanadium	70	200	100	50	100	100	100	50	100	70	150	1,000	500	200	70	100	200	150	90	30	150	100	100	70	<100	85	100	20
Yttrium	30	500	100	70	70	50	70	30	50	30	200	1,500	700	700	100	500	50	700	600	10	150	70	50	30	50	20	30	10
Zinc	<200	--	<200	<200	<200	<200	<200	<200	<200	260	<500	1,000	<500	<500	<500	<500	<200	<200	650	<200	300	<200	<200	30	30	<200	<200	16
Zirconium	100	>1,000	1,000	700	700	500	300	500	300	400	>2,000	>2,000	>2,000	>2,000	>2,000	>2,000	600	>1,000	>2,000	70	1,000	700	100	200	200	300	200	220

[1] AR--Anna Ruby Roadless Area (Lesure and others, 1987)
[2] CM--Craggy Mountain Wilderness Study Area (Lesure and others, 1987, p. 13-16)
[3] ER--Ellicott Rock Wilderness (Lane and others, 1985)
[4] TM--Tray Mountain Roadless Area (Koeppen and Nelson, 1988)
[5] SR--Shining Rock Wilderness (Lesure, 1981)
[6] Turekian (1977, p. 629)
[7] CN--Chattahoochee Roadless Area (Koeppen and Nelson, in press)
[8] SN--Southern Nantahala Wilderness (Peper and others, in press)
[9] Pettijohn (1963, p. 81)
[10] Order of magnitude (Turekian, 1977, p. 629)

INTRODUCTION

The U.S. Geological Survey (USGS) made a reconnaissance geochemical survey of the Blood Mountain Roadless Area to search for unexposed mineral deposits which might be recognized by a geochemical signature in the abundance or distribution patterns of trace elements. Forty five fine-grained stream-sediment samples and 45 panned-concentrate samples were collected in the Blood Mountain study area (fig. 1). A.E. Nelson, in conjunction with detailed geologic mapping, collected 13 rock-chip samples for geochemical analysis, in addition to a large number of hand specimens for thin-section study. Nelson's geologic study (1983), combined with this geochemical survey, provide the basis for our mineral-resource assessment of the Blood Mountain Roadless Area (Koeppen and others, 1983).

Geologic Setting

The Blue Ridge Mountains of northeastern Georgia and adjoining North Carolina consist of metamorphic rocks of two major lithotectonic units: the Great Smoky thrust sheet and the Richard Russell thrust sheet (Nelson, 1983). The Richard Russell thrust sheet was emplaced by westward tectonic transport over the Great Smoky thrust sheet, along the Hayesville-Fries thrust fault, a major structural feature of the southern Appalachians. Although rocks of the Great Smoky thrust sheet underlie the area at depth, only rocks of the Richard Russell thrust sheet are exposed within the roadless area (Nelson, 1983; Nelson and Gillon, 1985).

In the Blood Mountain Roadless Area, Richard Russell thrust sheet rocks consist of biotite gneiss, granite gneiss, amphibolite, and metasandstone of the Richard Russell Formation (Nelson and Gillon, 1985). The rocks are compositionally layered, and migmatites of biotite gneiss and granite gneiss are common. Discontinuous pods and veins of pegmatite are abundant and widely dispersed throughout the area. Rocks of the area are multiply deformed and fold interference patterns commonly are seen.

All rocks in the roadless area are at the sillimanite grade of regional Barrovian metamorphism. The thermal peak of regional metamorphism in the southern Appalachian Mountains is estimated to have occurred between 450 and 480 Ma during the Taconic orogeny; the migmatite, pegmatite, and felsic segregations in the roadless area probably formed during this time.

PROCEDURES

Most of the small drainage basins within and immediately adjacent to the study area were sampled by collecting a few handfuls of the finest sediment available and by pan concentrating heavy minerals from the alluvial gravels from the active stream channels. The samples were dried and sieved to minus 80-mesh (0.006 in.), then pulverized to minus 140-mesh (0.004 in.). Panned-concentrate samples were washed in bromoform to remove light minerals, then passed by hand magnet to remove most magnetite. The remaining material was then split into magnetic and nonmagnetic fractions on a Frantz isodynamic separator at a setting of 1.0 amp. The nonmagnetic fractions were crushed and pulverized to minus 140-mesh and analyzed. Rock chips similarly were crushed and pulverized for analysis.

Each sample was analyzed semiquantitatively for 31 elements by a six-step direct-current arc, optical-emission spectrographic method (Grimes and Marranzino, 1968) by D.F. Siems at the U.S. Geological Survey laboratories in Denver, Colo. Semiquantitative spectrographic analytical values are reported as six steps per order of magnitude (1.0, 0.7, 0.5, 0.3, 0.2, 0.15, or multiples of 10 of these numbers) and are approximate geometric midpoints of the concentration ranges whose boundaries are 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12, and so on. The analytical precision is shown to be within one adjoining reporting interval on each side of the reported value 83 percent of the time and within two adjoining intervals 96 percent of the time (Motooka and Grimes, 1976). The complete geochemical data for Blood Mountain Roadless Area and two adjacent study areas, Tray Mountain Wilderness Area and Chattahoochee Roadless Area, are reported in Siems and others (1988). Locations of samples and associated drainage basins are shown in figure 2. The statistical summary of the data is given in table 1.

DISCUSSION

A summary of the geochemical data (Siems and others, 1988) for 15 rock chips and 45 fine-grained stream-sediment samples is given in table 1; also given is data for similar samples from nearby areas for comparison. A distribution map is shown for higher values of thorium (fig. 3).

Our geochemical data for Blood Mountain Roadless Area show relatively small variations in abundance for most elements, but a few anomalies are recognized. One rock sample from the area (N424, fig. 2) contained detectable tin but at a concentration below the limit of determination (10 ppm). A panned-concentrate sample from Hugs Creek, about 2 mi east of the roadless area (and immediately beyond the edge of the map), contained 70 ppm tin; the source drainage basin for this sample is underlain by biotite gneiss and metasandstone lithologies of the Richard Russell Formation. No panned-concentrate or fine-grained sediment samples from within the Blood Mountain Roadless Area contained detectable tin. Low-grade tin anomalies occur at scattered locations both in rock and panned-concentrate samples derived from the Richard Russell Formation (Lesure and others, 1987; Koeppen and Nelson, in press), but no related source or significant mineralization has been identified. This single low value for tin in the rock is clearly anomalous but we consider that it is probably not related to significant mineralization.

Thorium contents of rock, panned-concentrate, and fine-grained sediment samples generally are below the spectrographic detection limit (100 ppm) for geologic samples in the Richard Russell thrust sheet. However, three panned-concentrate samples contained significant thorium (fig. 3): two had values between 1,000 and 1,500 ppm and a third had 300 ppm. Two fine-grained sediment samples taken from Hugs Creek and one of its small tributaries about 1.75 mi beyond the east boundary of the area contained detectable thorium (less than 100 ppm). An examination of the panned concentrates indicates that their mineralogy is dominantly zircon and monazite; the latter, or possibly fine-grained thorite, probably is the source of the thorium anomalies. Although geographically spread out, these stream-sediment samples are geologically clustered in biotite gneiss units immediately adjacent to granite gneiss, suggesting a metamorphic redistribution. The thorium enrichments may be concentration effects due to elemental mobility during migmatization within the Richard Russell Formation, but we see no evidence for significant thorium mineral concentrations or deposits.

The Blood Mountain study area is located 5 km from the Dahlonega gold belt, and gold-belt rocks may underlie the area. However, none of our geochemical samples contained measurable gold. Our data do not indicate anomalous metal concentrations in any other sample media. None of the geochemical data indicate that there are hidden mineral deposits in the Blood Mountain Roadless area.

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By
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1989

Manuscript approved for publication December 23, 1988

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MISCELLANEOUS FIELD STUDIES MAP
Published by the U.S. Geological Survey, 1989

KOEPPEN AND NELSON—GEOCHEMICAL SURVEY, BLOOD MOUNTAIN ROADLESS AREA, GA 1:30,000 MAP MF-1503-B